Mechanical-Optical Method of Resolution Enhancement Through Integration of Multiple Exposures Associated with Varying Sensor Orientations

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Introduction

As the rate of improvement of opto-electronic photosensors is slowing, methods which allow for extant sensors to be used to greater effect are desired.

The following proposal may prove useful in scenarios wherein imaging sensors are ultra-stable and wherein longer exposure times are acceptable (the photography of stationary objects.)

Abstract

If one was limited to a camera with a sensor resolution of a single pixel, how would one go about creating an image of resolution comparable to a modern opto-electronic sensor? One would have to re-orient the camera in each of millions of discrete and carefully controlled directions and capture separate images which would have to be subsequently re-integrated into a single image.

The fact that we have sensors capable of creating images with millions of pixels does not mean that we are prohibited from capturing a number of discrete images with such advanced sensors and re-integrating the images in order to create meta-images of greater resolution.

If we capture images in which the orientation of the sensor is altered by an amount of angle equal to a half pixel up, down, left and right of its standard orientation, we can deduce the contents of the area in the space between the “real” pixels of the image. This approach would require extremely accurate control over the direction of orientation of a sensor, the ability to alter this orientation rapidly, the time to capture five photographic exposures rather than one and the processing capability to integrate the images (a modest computational task.)

Conclusion

Although it has as a limitation that the sensor and the subject of the photograph be static, this approach is nonetheless useful for enhancing the resolution of photographs using extant technologies. It represents the outset of a paradigm in which resolution may be endlessly increased as a function of exposure time and wherein increased exposure times may allow for the generation of enhanced-resolution images rather than merely overexposed images.